

What is claimed is:

1. A device for filtering fluid flowing through a lumen defined by the wall of an anatomical structure comprising:

5 a guidewire; and

a filter element mounted on the guidewire, the filter element having proximal and distal ends and being expandable from a collapsed configuration when the filter element is restrained to an expanded configuration when the filter element is unrestrained, the filter element 10 having a shape in the expanded configuration which defines a cavity having a proximally facing opening, the guidewire extending to at least the distal end of the filter element.

2. The device of claim 1 wherein the filter element is self-expandable.

15 3. The device of claim 1 further comprising means for expanding the filter element from the collapsed configuration to the expanded configuration.

4. The device of claim 3 wherein the means for expanding comprises

20 the filter element being comprised of nitinol.

5. The device of claim 1 wherein the filter element is attached to the guidewire at a distal region of the guidewire.

25 6. The device of claim 1 wherein the distal end of the filter element is connected to a distal band which encircles the guidewire.

7. The device of claim 6 wherein the distal band is connected in a fixed position on the guidewire.

8. The device of claim 6 wherein the proximal end of the filter element is connected to a proximal band which encircles the guidewire.

9. The device of claim 8 wherein one of the proximal and distal bands is connected in a fixed position on the guidewire.

10. The device of claim 8 wherein the proximal band is slidably disposed about the guidewire.

10 11. The device of claim 8 wherein when the filter element is in the collapsed configuration the distal and proximal bands are spaced apart a first distance and when the filter element is in the expanded configuration the proximal and distal bands are spaced apart a second distance, the first distance being greater than the second distance.

15 12. The device of claim 1 wherein when the filter element is in the expanded configuration a proximal portion of the filter element is of sufficient size and shape to engage the wall of the vessel.

20 13. The device of claim 12 wherein the filter element has a shape in the expanded configuration which decreases in size from the proximal portion to the distal end of the filter element.

14. The device of claim 1 wherein the filter element comprises a metal mesh.

25 15. The device of claim 14 wherein the filter element comprises nitinol.

16. The device of claim 1 wherein the guidewire includes a flexible

30 portion extending distally of the distal end of the filter element.

17. The device of claim 1 wherein the guidewire comprises a solid material.

5 18. The device of claim 1 wherein the guidewire comprises metal.

19. The device of claim 1 wherein the guidewire comprises a tapered portion.

10 20. A device for filtering fluid flowing through a lumen defined by the wall of an anatomical structure comprising:

15 a filter element having proximal and distal ends and being expandable from a collapsed configuration when the filter element is restrained to an expanded configuration when the filter element is unrestrained, the filter element having a shape in the expanded configuration which defines a cavity having a proximally facing opening; and

means for carrying the filter element, the carrying means extending to at least the distal end of the filter element.

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21. The device of claim 20 wherein the filter element is self-expandable.

22. The device of claim 20 further comprising means for expanding the filter element from the collapsed configuration to the expanded configuration.

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23. The device of claim 22 wherein the means for expanding comprises the filter element being comprised of nitinol.

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24. The device of claim 20 wherein the filter element is attached to the carrying means at a distal region of the carrying means.

25. The device of claim 20 wherein the distal end of the filter element is connected to a distal band which encircles the carrying means.

5 26. The device of claim 25 wherein the distal band is connected in a fixed position on the carrying means.

27. The device of claim 25 wherein the proximal end of the filter element is connected to a proximal band which encircles the carrying means.

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28. The device of claim 27 wherein one of the proximal and distal bands is connected in a fixed position on the carrying means.

15 29. The device of claim 27 wherein the proximal band is slidably disposed about the carrying means.

30. The device of claim 27 wherein when the filter element is in the collapsed configuration the distal and proximal bands are spaced apart a first distance and when the filter element is in the expanded configuration the proximal  
20 and distal bands are spaced apart a second distance, the first distance being greater than the second distance.

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31. The device of claim 20 wherein when the filter element is in the expanded configuration a proximal portion of the filter element is of sufficient size  
25 and shape to engage the wall of the vessel.

32. The device of claim 31 wherein the filter element has a shape in the expanded configuration which decreases in size from the proximal portion to the distal end of the filter element.

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33. The device of claim 20 wherein the filter element comprises a metal mesh.

34. The device of claim 33 wherein the filter element comprises nitinol.

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35. The device of claim 20 wherein the carrying means includes a flexible portion extending distally of the distal end of the filter element.

36. The device of claim 20 wherein the carrying means comprises a solid material.

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37. The device of claim 20 wherein the carrying means comprises metal.

38. The device of claim 20 wherein the carrying means comprises a tapered portion.

39. The device of claim 20 wherein the carrying means comprises a guidewire.

40. A method of filtering fluid flowing through a lumen defined by the wall of an anatomical structure comprising:

providing a guidewire including a filter element mounted on a distal portion of the guidewire, the filter element having a distal end and being expandable from a collapsed configuration when the filter element is restrained to an expanded configuration when the filter element is unrestrained, the filter element having a shape in the expanded configuration which defines a cavity having a proximally facing opening, the guidewire extending to at least the distal end of the filter element;

introducing the guidewire into the lumen of the anatomical structure while the filter element is restrained in the collapsed configuration;

- advancing the guidewire through the lumen until the filter element is positioned at a desired location;
- removing the restraint on the filter element to expand the filter element to its expanded configuration;
- 5 filtering fluid flowing through the lumen into the opening in the cavity of the filter element;
- closing the opening to the cavity of the filter element; and
- removing the guidewire and filter element from the lumen of the anatomical structure.

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41. The method of claim 40 wherein in the step of providing a guidewire the guidewire comprises a solid material.

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42. The method of claim 40 wherein in the step of providing a guidewire the guidewire comprises metal.

43. The method of claim 40 wherein in the step of providing a guidewire the guidewire comprises a tapered portion.

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44. The method of claim 40 wherein in the step of providing a guidewire the filter element is self-expandable.

45. A method of filtering emboli from fluid flowing through a lumen defined by the wall of an anatomical structure comprising:

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providing a guidewire including a filter element mounted on a distal portion of the guidewire, the filter element having a distal end and being expandable from a collapsed configuration when the filter element is restrained to an expanded configuration when the filter element is unrestrained, the filter element having a shape in the expanded

configuration which defines a cavity having a proximally facing opening, the guidewire extending to at least the distal end of the filter element;

introducing the guidewire into the lumen of the anatomical structure while the filter element is restrained in the collapsed configuration;

5 advancing the guidewire through the lumen until the filter element is positioned at a desired location;

removing the restraint on the filter element to expand the filter element to its expanded configuration;

filtering emboli from fluid flowing through the lumen into the 10 opening in the cavity of the filter element;

collapsing the filter element about the emboli to capture the emboli in the cavity of the filter element; and

removing the guidewire and filter element from the lumen of the anatomical structure.

15 46. The method of claim 45 wherein the step of collapsing the filter element comprises closing the opening to the cavity of the filter element.

47. The method of claim 45 wherein in the step of providing a guidewire 20 the guidewire comprises a solid material.

48. The method of claim 45 wherein in the step of providing a guidewire the guidewire comprises metal.

25 49. The method of claim 45 wherein in the step of providing a guidewire the guidewire comprises a tapered portion.

50. The method of claim 45 wherein in the step of providing a guidewire the filter element is self-expandable.

51. A method of filtering fluid flowing through a lumen defined by the wall of an anatomical structure comprising:

providing a filter device including a filter element and means for carrying the filter element, the filter element having a distal end and being expandable from a collapsed configuration when the filter element is restrained to an expanded configuration when the filter element is unrestrained, the filter element having a shape in the expanded configuration which defines a cavity having a proximally facing opening, the carrying means extending to at least the distal end of the filter element;

10 introducing the carrying means into the lumen of the anatomical structure while the filter element is restrained in the collapsed configuration;

advancing the carrying means into the lumen until the filter element is positioned at desired location;

15 removing the restraint on the filter element to expand the filter element to its expanded configuration;

filtering fluid flowing through the lumen into the opening in the cavity of the filter element;

closing the opening to the cavity of the filter element; and

20 removing the carrying means and filter element from the lumen of the anatomical structure.

52. The method of claim 51 wherein in the step of providing the filter device, the carrying means comprises solid material.

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53. The method of claim 51 wherein in the step of providing the filter device, the carrying means comprises metal.

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54. The method of claim 51 wherein in the step of providing the filter device, the carrying means comprises a tapered portion.

55. The method of claim 51 wherein in the step of providing the filter device, the carrying means comprises a guidewire.

56. The method of claim 51 wherein in the step of providing the filter device, the filter element is self-expandable.